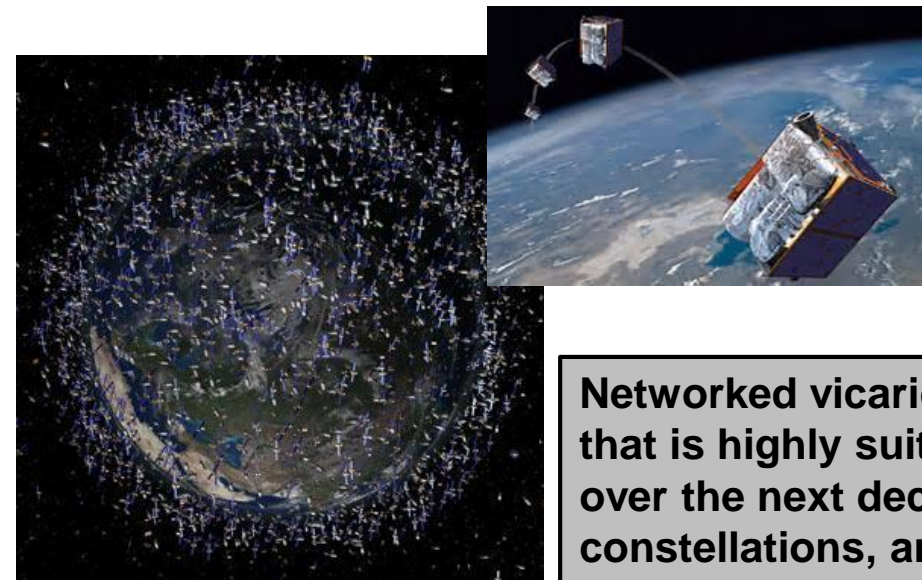
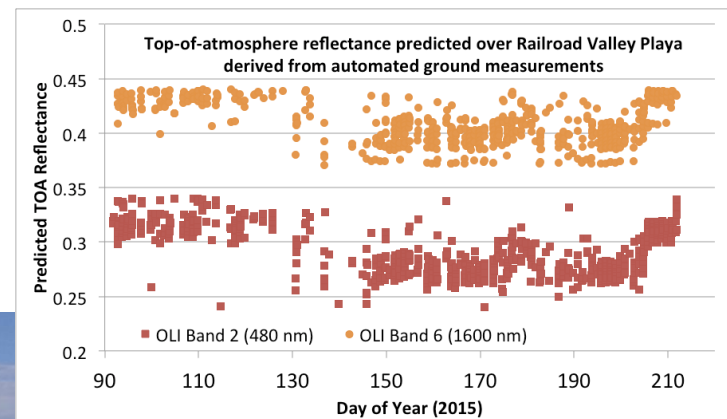
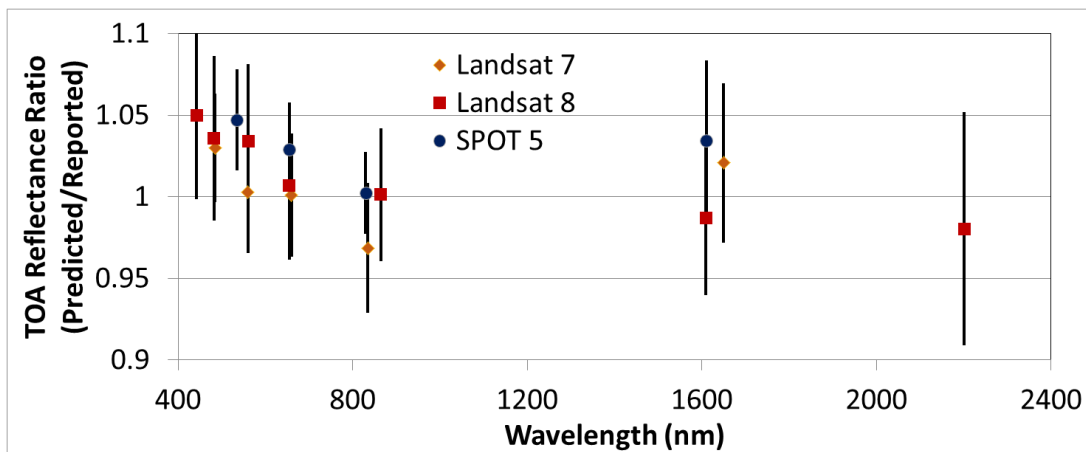




Networking of automated ground measurements for sensor calibration

K. Thome¹, J. Czapla-Myers², J. McCorkel¹, B. Wenny¹

¹Code 618, NASA/GSFC and SSAI, ²University of Arizona



Networked vicarious calibration will provide an additional tool that is highly suited for expected rise in number of imagers over the next decade (including research sensors, small-sats, constellations, and commercial systems)



Name: Kurtis Thome, NASA/GSFC, Code 618

E-mail: kurtis.thomet@nasa.gov

Phone: 301-614-6671

References:

Czapla-Myers, J., K. J. Thome, N. Anderson, and S. Biggar. 2014. "The absolute radiometric calibration of Terra imaging sensors: MODIS, MISR, and ASTER." Proceedings of SPIE 9218 [10.1117/12.2062529]

Data Sources:

MODIS, MISR, ASTER, ETM+, OLI, SPOT-5 HRVIR, AERONET

Technical Description of Figures:

Graph 1: Ratio of top-of-atmosphere reflectance predicted from automated ground-based measurements to those reported by three sensors while viewing the Railroad Valley Playa, Nevada. Predicted values are based on a simulation of expected networked results based on downsampled temporal and spectral data.

Graph 2: Top-of atmosphere reflectance from spring/summer of 2015 derived from the hyperspectral predictions for two Landsat 8 bands. Graph shows 13 data points per day at 30 minute intervals. Gaps are due to cloudy periods. Scatter is caused by surface BRDF effects and unfiltered cloud effects. Apparent shift in reflectance around DOY 150 is a known effect caused by wind erosion removing a bright salt deposit from winter percolation.

Image1: Photograph showing ground-viewing radiometer that is the key to assessing surface reflectance of the test site. Not shown is the AERONET sensor that provides atmospheric information. Equipment is maintained and operated by the Remote Sensing Group of the College of Optical Sciences at the University of Arizona.

Images2, 3: Figures show the RapidEye constellation and a cartoon of current LEO objects currently being tracked by the US Air Force. Figures are to emphasize the difficulties that are expected as we attempt to characterize a larger number of sensors as we move towards distributed missions, constellation approaches, commercial providers, and broader international participation.

Scientific significance, societal relevance, and relationships to future missions:

As the number of Earth-observation satellites is ever increasing, one of the challenges for the scientific community is to ensure that the absolute radiometric calibration of these sensors resides on the same SI-traceable scale. Individual teams, equipment, and sites are typically used to assess the post-launch radiometric calibration of each instrument by simulating top-of-atmosphere signals from in-situ surface and atmosphere measurements. Such assessment based on a single site/instrumentation can lead to radiometric biases between satellite sensor radiometry.

The Radiometric Calibration Network (RadCalNet) working group (WG) (formerly known as Landnet) as part of the Committee on Earth Observation Satellite's Working Group on Calibration and Validation is currently working on a prototype methodology that seeks to minimize calibration biases by creating a standardized network of sites and data processing protocols. Such a network approach will also greatly improve the temporal frequency at which an EO sensor radiometric accuracy can be assessed.

The Railroad Valley Playa results shown here are being used to help define the protocols needed for RadCalNet data collections and processing. Future efforts will include additional sensors as well as combining data from additional test sites. Making predictions of top-of-atmosphere reflectance available to a wide user community will allow satellite providers from developing countries and commercial providers to place their sensor's data products on similar radiometric scales to NASA assets allowing NASA users access to more consistent data sets for data fusion.